We claim:

1. A fuel cell unit comprising:

a circular membrane electrode assembly (MEA), said MEA includes a cathode, a proton exchange membrane (PEM), and an anode, at least a cathodic terminal and an anodic terminal, an air flow duct on the cathode side of the MEA, an annular fuel reservoir on the anode side of the MEA, said fuel reservoir contains a mixture of methanol and water as fuel, and at least a carbon dioxide (CO_2) relief valve communicating with said fuel reservoir, thereby fuel is supplied through said fuel reservoir to said anode of the MEA and oxygen is supplied from said air flow duct to said cathode of the MEA, and thereby electricity is generated in the fuel cell unit and is delivered through said cathodic terminal and said anodic terminal to an external power load.

2. The fuel cell unit of claim 1 further comprising a fuel feeding valve, said feeding valve communicates with an external fuel tank for additional fuel supply to said fuel reservoir.

3. The fuel cell unit of claim 1 further comprising a control unit, said control unit applies a continuous instantaneous pulsed load cycle to the fuel cell unit to improve the stability of the fuel cell power output and the catalysis activity of the MEA.

4. The fuel cell unit of claim 1 further including a porous structure on the anode side of the MEA, whereby the fuel is supplied to said anode through capillary force effect and whereby the mechanical strength of the MEA is enhanced.

5. The fuel cell unit of claim 4 wherein said porous structure is coated with a thin layer of metal on the surface of the porous structure that is in direct contact with the anode of the MEA, said thin metal layer serves as a metallic current collector and is in electric communication with said anodic electrical terminal.

6. The fuel cell unit of claim 1 further including a porous structure on the cathode side of the MEA, whereby the mechanical strength of the MEA is enhanced.

7. The fuel cell unit of claim 6 wherein said porous structure is coated with a thin layer of metal on the surface of the porous structure that is in direct contact with the cathode of the MEA, said thin metal layer serves as a metallic current collector and is in electric communication with said cathodic electrical terminal.

8. The fuel cell unit according to claim 1, wherein said CO_2 relief valve releases CO_2 from said fuel reservoir at a set reservoir pressure and retains the fuel within the reservoir, whereby the fuel reservoir is effectively maintained at a set pressure.

9. A fuel cell system comprising:

a plurality of circular membrane electrode assemblies (MEAs), each said MEA includes a cathode, a proton exchange membrane (PEM), an anode, at least a cathodic terminal and an anodic terminal, a plurality of air flow ducts, each said air flow duct being on the cathode side of the associated MEA, a fuel reservoir on the anode side of the MEAs, said fuel reservoir contains a mixture of methanol and water as fuel, and at least a carbon dioxide (CO_2) relief valve communicating with said fuel reservoir, thereby fuel is supplied through said fuel reservoir to said anodes of the MEAs and oxygen is supplied from said air flow ducts to said cathodes of the MEAs, and thereby electricity is generated in the fuel cell system and is delivered through said cathodic terminals and said anodic terminals to an external power load.

10. The fuel cell system according to claim 9, wherein said cathodic terminals are connected in series and wherein said anodic terminals are connected in series.

11. The fuel cell system of claim 9 further comprising a fuel feeding valve, said feeding valve communicates with an external fuel tank for additional fuel supply to said fuel reservoir.

12. The fuel cell system of claim 9 further comprising at least a control unit, said control unit applies a continuous instantaneous pulsed load cycle to the fuel cell system to improve the stability of the fuel cell power output and the catalysis activity of the MEAs.

13. The fuel cell system of claim 9 further including a porous structure on the anode side of each MEA, whereby the fuel is supplied to said anode through capillary force effect and whereby the mechanical strength of the MEA is enhanced.

14. The fuel cell unit of claim 13 wherein said porous structure is coated with a thin layer of metal on the surface of the porous structure that is in direct contact with the anode of the MEA, said thin metal layer serves as a metallic current collector and is in electric communication with said anodic electrical terminal.

15. The fuel cell system of claim 9 further including a porous structure on the cathode side of each MEA, whereby the mechanical strength of the MEA is enhanced.

16. The fuel cell unit of claim 15 wherein said porous structure is coated with a thin layer of metal on the surface of the porous structure that is in direct contact with the cathode of the MEA, said thin metal layer serves as a metallic current collector and is in electric communication with said cathodic electrical terminal.

17. The fuel cell system according to claim 9, wherein said CO_2 relief valve releases CO_2 from said fuel reservoir at a set reservoir pressure and retains the fuel within the reservoir, whereby the fuel reservoir is effectively maintained at a set pressure.

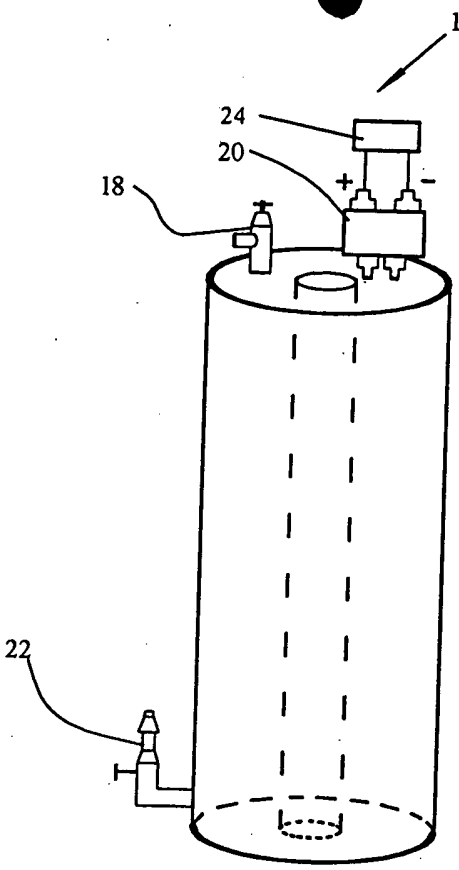

Fig.1

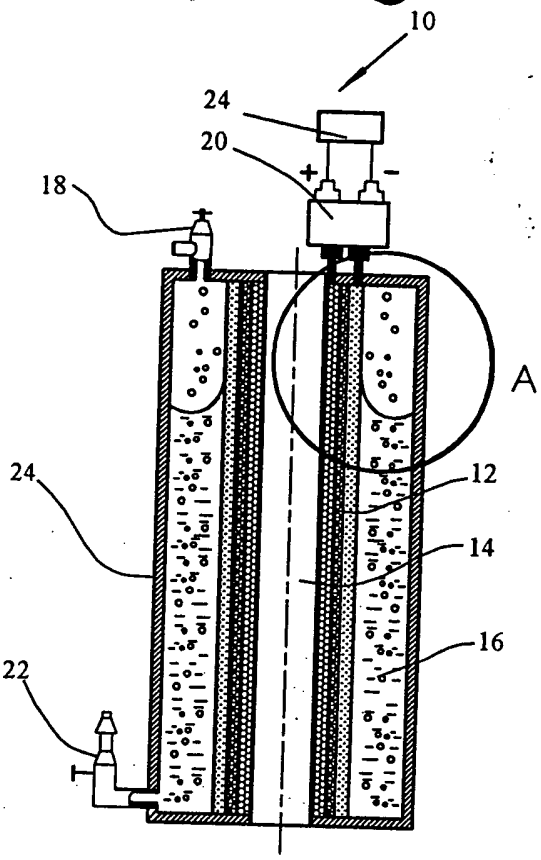

Fig.2

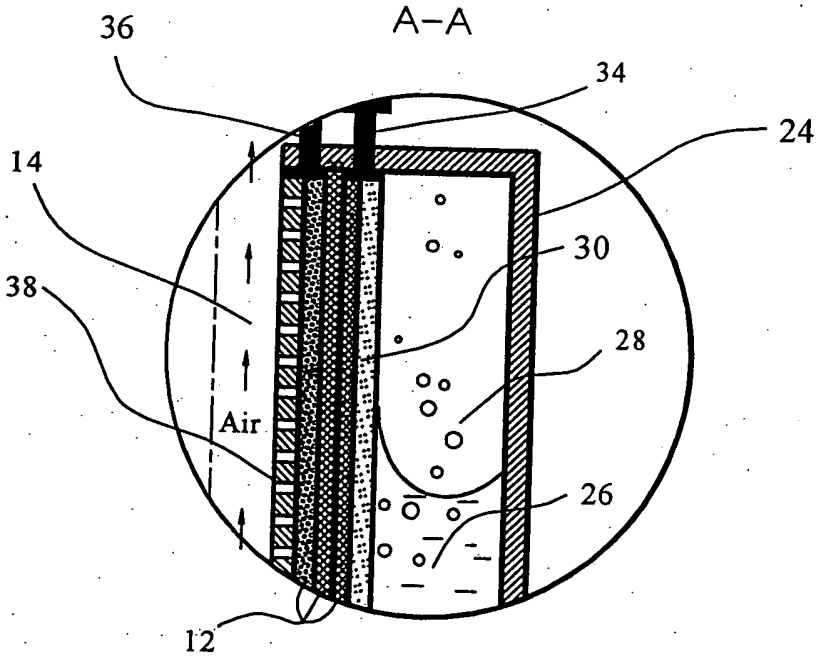

Fig.3

#4

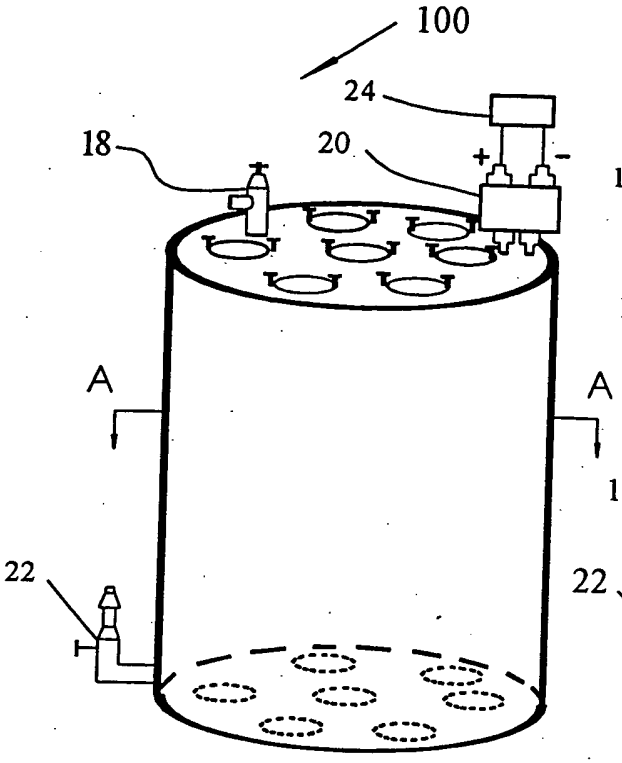

Fig.4

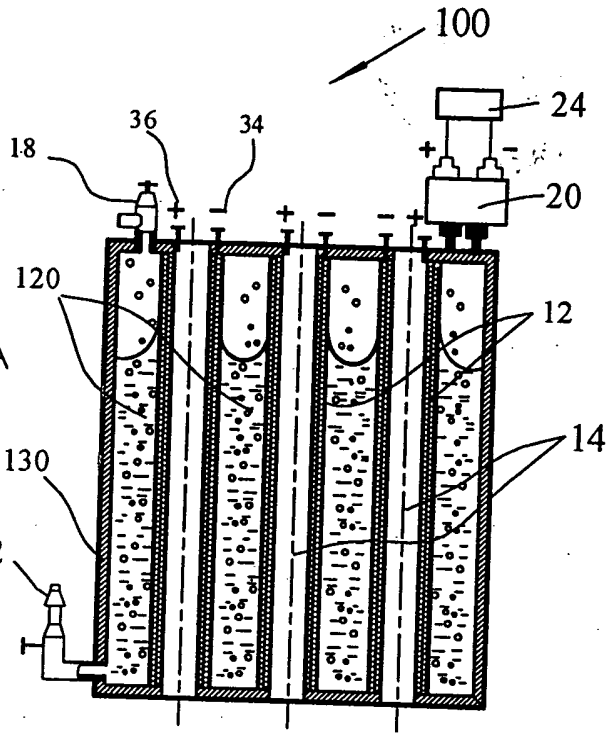

Fig.5

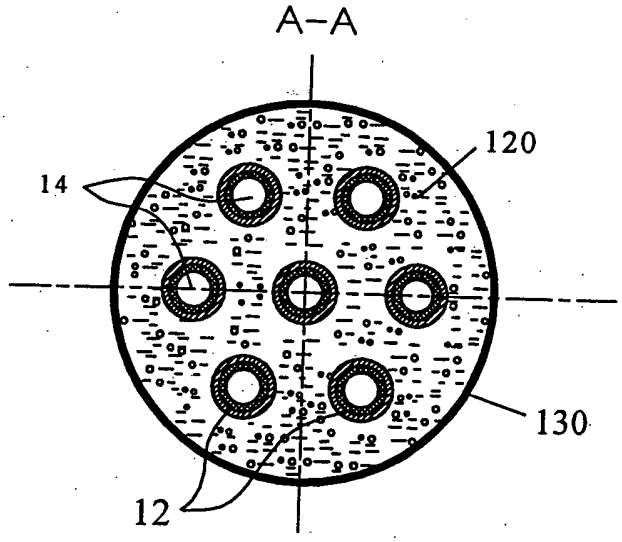

Fig.6